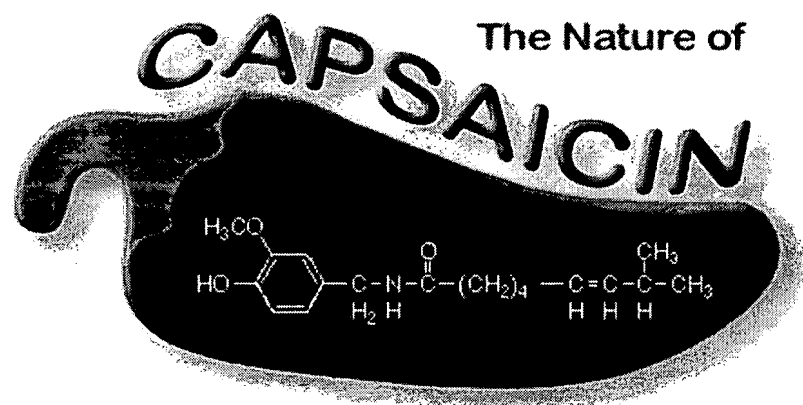




## Heat Up Your Life! 3-Hour DVD About Chiles


**FIERY-  
FOODS  
.COM**

home



by Dave DeWitt

The active principle that causes the heat in chile peppers is a crystalline alkaloid generically called *capsaicin*. It is produced by glands at the junction of the placenta and the pod wall. The capsaicin spreads unevenly throughout the inside of the pod and is concentrated mostly in the placental tissue.

Capsaicin is an incredibly powerful and stable alkaloid seemingly unaffected by cold or heat, which retains its original potency despite time, cooking, or freezing. Because it has no flavor, color, or odor, the precise amount of capsaicin present in chiles can only be measured by a specialized laboratory procedure known as high performance liquid chromatography (HPLC). Although it has no odor or flavor, it is one of the most pungent compounds known, detectable to the palate in dilutions of one to seventeen million. It is slightly soluble in water, but very soluble in alcohols, fats, and oils.

P.A. Bucholtz in 1816 first discovered that the pungent principle of peppers could be extracted from the macerated pods with organic solvents. In 1846, L. T. Thresh reported in *Pharmacy Journal* that the pungent principle could be extracted in a crystalline state. It was Thresh who named the substance capsaicin. In 1878, the Hungarian medical scientist Endre Hogeny extracted capsaicin, which he called capsicol, and discovered that it stimulated the mucous membranes of the mouth and stomach and increased the secretion of gastric juices. Capsaicin was first synthesized in 1930 by E. Spath and F.S. Darling.

The word capsaicin actually describes a complex of related components named capsaicinoids by Japanese chemists S. Kosuge and Y. Inagaki in 1964. Capsaicinoids are the chemical compounds that give chile peppers their bite. Scientists have identified and isolated six naturally occurring members of this fiery family and one synthetic cousin, which is used as a reference gauge for determining the relative pungency of the others.

The major capsaicinoids that are contained in the crystalline extract and their percentages are capsaicin (69%), dihydrocapsaicin (22%), and three minor related components: nordihydrocapsaicin (7%), homocapsaicin (1%), and homodihydrocapsaicin (1%).

The synthetic capsaicinoid vanillylamide of n-nonanoic acid (VNA), was administered to sixteen trained tasters by researchers Anna Krajewska and John Powers at the University of Georgia. The tasters compared the heat of VNA to the four natural capsaicinoids and the results were as follows.

The mildest capsaicinoid was nordihydrocapsaicin (NDHC), which was described as the "least irritating" and "fruity, sweet, and spicy." Next was homodihydrocapsaicin (HDHC), a compound described as "very irritating," and one that produced a "numbing burn" in the throat, which also was the most prolonged and difficult to rinse out.

The two most fiery capsaicinoid compounds were capsaicin (C) and dihydrocapsaicin (DHC), which

produced burning everywhere from the mid-tongue and palate down into the throat. Evidently, all of the capsaicinoids work together to produce the pungency of peppers, but capsaicin itself is still rated the strongest.

Pure capsaicin is so powerful that chemists who handle the crystalline powder must work in a filtered "tox room" in full body protection. The suit has a closed hood to prevent inhaling the powder. Said pharmaceutical chemist Lloyd Matheson of the University of Iowa, who once inhaled some capsaicin accidentally: "It's not toxic, but you wish you were dead if you inhale it." "One milligram of pure capsaicin placed on your hand would feel like a red-hot poker and would surely blister the skin," said capsaicin expert Marlin Bensinger.

Did capsaicin evolve to protect chile peppers from mammalian predators? That's the theory of Dr. Michael Nee of the New York Botanical Garden. Scientists have long speculated that plants produce secondary metabolites, chemicals that are not required for the primary life support of the plant. These metabolites fight off animal predators and perhaps even competing plant species.

Nee speculates that the capsaicin in chiles may be such a metabolite. It prevents animals from eating the chiles, so that they can be consumed by fruit-eating birds who specialize in red fruits with small seeds. Mammals perceive a burning sensation from capsaicin but birds do not. The seeds pass through the birds' digestive tract intact and encased in a perfect natural fertilizer. Many experts believe that the wild chiltepin (*C. annuum* var. *aviculare*) was spread by this method from South America to what is now the U.S.-Mexico border.

It has long been believed that capsaicin was present only in the pods of the *Capsicum* genus and in no other plant or animal material. However, during my research I uncovered a quote from W. Tang and G. Eisenbrand in *Chinese Drugs of Plant Origin*: "Capsaicin, the pungent principle of *Capsicum* species, was isolated from ginger rhizome." Chemical engineer and capsaicin expert Marlin Bensinger strongly believes this finding to be in error. He says the proper chemical precursors are simply not found in ginger.

### Toxicity of Capsaicinoids

In order to determine the lethal toxic level of capsaicinoids in animals, and to extrapolate that level for humans, researchers in 1980 performed a rather gruesome experiment with mice, rats, guinea pigs and rabbits. Pure capsaicin was administered intravenously, subcutaneously, in the stomach, and applied topically until the animals died. The lethal toxic doses of capsaicin, measured in milligrams per kilogram of animal weight ranged from a mere .56 milligrams when administered intravenously to 190 milligrams when consumed to 512 milligrams when applied topically--which means that the poor animals were drowned in it. Indeed, the probable cause of death in all cases was presumed to be respiratory paralysis. Guinea pigs were the most sensitive to capsaicin, while rabbits were less susceptible. The author of the study, T. Glinsukon, concluded that the acute toxicity of capsaicinoids as a food additive in mankind was negligible. If humans are about as sensitive as mice, the acute fatal toxicity dose for a 150 pound person would be about thirteen grams of pure, crystalline capsaicinoids, which frankly, sounds high to us. I think that less than that would be lethal.

There have been investigations in dangerous doses in humans of the various substances that have capsaicin as an ingredient. For example, C.L. Winek conducted a study that was published in *Drug and Chemical Toxicology* that examined the overdose potential of Tabasco® Sauce. He concluded that a person of average weight would have to consume nearly a half gallon of the sauce to overdose and become unconscious.

In a related study, rats were fed large amounts of Tabasco® Sauce and suffered "no gross or microscopic pathological changes or any significant biochemical changes in the animals." Their growth rate also remained normal. In a similar study, rats were fed crude extracts of chile pods and crystalline capsaicinoids by stomach tube while allowed access to normal food and water. None of the rats died and they all appeared normal throughout the study. Of course, the rats were killed and then autopsied, but no gross pathological changes were detected.

Humans have also acted as guinea pigs with oleoresin capsicum. It is an ingredient in super-hot sauces with

words in the name like insanity, death, and suicide. These sauces are tasted at food shows by people who have no idea of how hot they are. Some people, with few tastebuds in the mouths, are not bothered by the extreme heat. But most people react very negatively to the super-hot sauces, experiencing severe burning and sometimes blistering of the mouth and tongue. Other immediate responses have included shortness of breath, fainting, nausea, and spontaneous vomiting. People should be very careful of commercial hot sauces that list oleoresin capsicum as an ingredient.

Aside from the above adverse effects, the super-hot sauce will not hurt you. "Comprehensive nutritional studies have not shown any adverse effects of chile or capsaicinoids even at ten times the maximum use levels," wrote the one world's experts on capsaicin, V.S. Govindarajan, author of the mammoth study, *Capsicum--Production, Technology, Chemistry and Quality*. But even if you do overindulge in capsaicinoids, do not worry, for they are quickly metabolized in the liver and excreted in urine within a few hours.

Article excerpted from *The Chile Pepper Encyclopedia* (William Morrow, 1999)

---

**Related article:**

[Creams, Sprays, Gels, Sticks, Powders, and Compounds: A Capsaicin Update](#)

[Top of Page](#)